Active Project (2016 - 2016)

FLEXIBLE, HIGH CHAR YIELD HYBRIDSIL ADHESIVE MATERIALS FOR NEXT GENERATION ABLATIVE THERMAL PROTECTION SYSTEMS, Phase I Project

SBIR/STTR Programs | Space Technology Mission Directorate (STMD)

ABSTRACT

NanoSonic will create and empirically validate flexible, high char yield HybridSil adhesive nanocomposites for use within current and next generation polymer based ablative thermal protection systems during the proposed NASA SBIR program. Building from its established high temperature HybridSil material technology, NanoSonic will develop a room temperature cured hybrid organic inorganic adhesive material for bonding polymer infused tiles within advanced thermal protection systems. The proposed HybridSil nanocomposite will be molecularly engineered for exceptional adhesion to both EDL substrates and currently employed high temperature thermosets (phenolic, epoxy, and cyanate ester) while maintaining high strains to failure and a rapid conversion robust silicates at elevated temperatures for additional substrate protection. Leveraging a base HybridSil thermoset that has previously demonstrated promising HyMETS performance as a carbon felt infusing resin (Figure 1 and right inset), NanoSonic will synthesize hybrid organic inorganic block and segmented copolymers molecularly engineered for exceptional adhesion to carbon felt tiles infused with aromatic thermosets while maintaining glass transition temperatures < - 100 oC and high strains to failure (>100%) for retained flexibility in space. Promising structure property interdependencies affording adhesive materials with extreme ablative adhesion, high char yields, and thermal resilience will be empirically down-selected through rigorous high temperature (2,000 oC) flow testing with the Department of Aeronautics and Astronautics at the University of Washington.

ANTICIPATED BENEFITS

To NASA funded missions:

Potential NASA Commercial Applications: Primary NASA applications will include entry, descent and landing ablative

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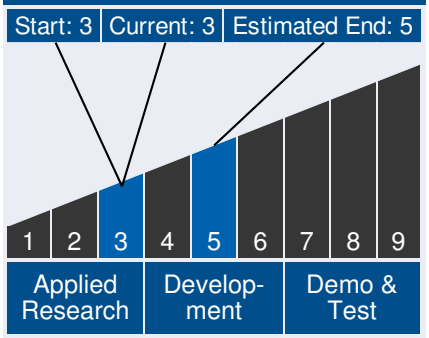
Technology Maturity



Management Team

Program Executives:

- Joseph Grant
- Laguduva Kubendran

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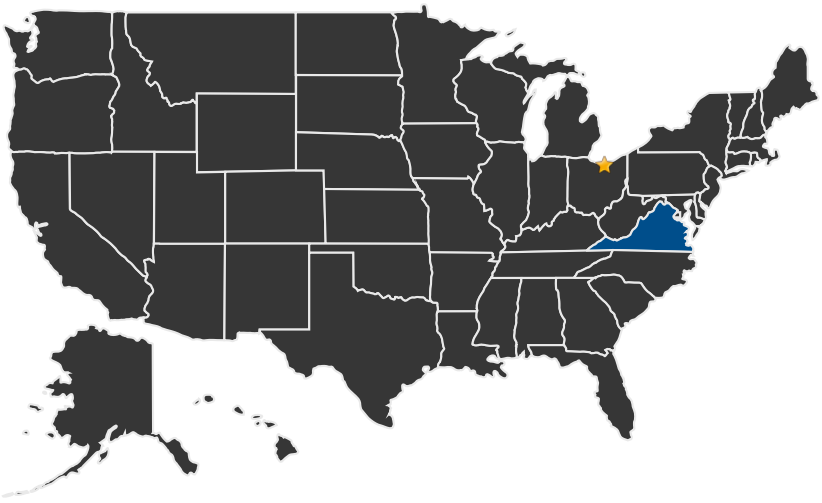
thermal protection systems for future planetary entry vehicles while immediate secondary applications will include spacecraft aerocapture systems. Additional NASA applications will include utility within a broad spectrum of reentry body heatshield systems.

To the commercial space industry:

Potential Non-NASA Commercial Applications: Broad secondary non-NASA applications exist for NanoSonic's HybridSil TPS tile adhesives. Immediate Phase III transition potential will exist within an array of aerospace heatshield systems, as well as fire protective materials within the aerospace, marine, and automotive industries.

U.S. WORK LOCATIONS AND KEY PARTNERS



U.S. States With Work

Lead Center:
Glenn Research Center

Other Organizations Performing Work:

- Nanosonic, Inc. (Pembroke, VA)

Management Team *(cont.)*

Program Manager:
- Carlos Torrez

Principal Investigator:
- Victor Baranauskas

Technology Areas

Primary Technology Area:
Entry, Descent, and Landing Systems (TA 9)
- Aeroassist and Atmospheric Entry (TA 9.1)
  - Thermal Protection Systems for Rigid Decelerators (TA 9.1.1)

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PROJECT LIBRARY

Presentations

- Briefing Chart
  - (http://techport.nasa.gov:80/file/23511)

IMAGE GALLERY

FLEXIBLE, HIGH CHAR YIELD HYBRIDSIL ADHESIVE MATERIALS FOR NEXT GENERATION ABLATIVE THERMAL PROTECTION SYSTEMS, Phase I

DETAILS FOR TECHNOLOGY 1

Technology Title

FLEXIBLE, HIGH CHAR YIELD HYBRIDSIL ADHESIVE MATERIALS FOR NEXT GENERATION ABLATIVE THERMAL PROTECTION SYSTEMS, Phase I

Potential Applications

Primary NASA applications will include entry, descent and landing ablative thermal protection systems for future planetary entry vehicles while immediate secondary applications will include spacecraft aerocapture systems. Additional NASA applications will include utility within a broad spectrum of reentry body heatshield systems.